# SUPPLEMENT.


# The Mining Journal,

## RAILWAY AND COMMERCIAL GAZETTE:

**FORMING A COMPLETE RECORD OF THE PROCEEDINGS OF ALL PUBLIC COMPANIES.**

No. 1800.—Vol. XL. LONDON, SATURDAY, FEBRUARY 19, 1870. {STAMPED .. SIXPENCE. UNSTAMPED.FIVEPENCE


### REGULATION AND INSPECTION OF MINES.

The new Bill to consolidate and amend the Acts relating to the regulation and inspection of mines has now been printed, and as the Home Secretary has had ample opportunity of judging, from the opinions which have been so freely expressed by the representatives of both masters and workmen, the precise provisions best calculated to meet the exigencies of the case, it may be assumed that it will become law nearly in the same form as that in which it now stands. The Act is to include all mines except coal and ironstone mines in Ireland. The term mine includes mines of every description, and every shaft in the course of being sunk, and level or inclined plane in course of being driven, for commencing or opening any mine, or for searching for or proving minerals, and all the works, machinery, tramways, and sidings, both below ground and above ground, in and adjacent to a mine, or any such shaft, level, or inclined plane.

In the clauses referring to the employment of women and children, &c., it is provided that no child under twelve years and no woman above that age shall be employed underground. No lad above twelve or under sixteen can be employed more than twelve consecutive hours, with one hour and a half allowed for meals, and there must be ten hours between each such period of employment. The provisions of the Workshop Regulation Act, 1867, is to extend to all women, young persons, and children employed above ground in connection with any mine, in the same manner as if the place in which they are so employed were a workshop within the meaning of that Act. A register showing name, age, residence, and date of first employment of every lad under sixteen employed. Lads under eighteen must not be employed about engines or machinery for raising and lowering workmen when steam or mechanical power is used. When animal or manual labour is used the lad must not be under 15 years old. The penalty for contravention of these provisions fall upon the mine-owner, or upon the parent or guardian, according as one or other may be in fault.

The payment of wages must be made beyond the limits of the public-house and the ordinary Inspector of Weight and Measures. After the commencement of the Act no mine must be worked with a single shaft, and power is given to enforce compliance by injunction; and to meet the cases of certain leases it is provided that no penalty shall attach to anyone for making the second shaft in compliance with the Act. Subjoined are the new general rules :—

#### REGULATIONS TO BE OBSERVED IN COAL AND IRONSTONE MINES.

The following regulations shall be observed in every coal and ironstone mine by the owner and agent thereof :—

An amount of ventilation shall be constantly produced in every coal and ironstone mine adequate to dilute and render harmless noxious gases to such an extent that the working places of the pits, levels, and workings of every such mine, and the travelling roads to and from such working places, shall be in a fit state for working and passing therein.

Provided that no owner, agent, or other person shall be held to have acted in contravention of this regulation, if it is shown that all reasonable precautions have been taken by the owner, agent, or person who is so charged.

All entrances to any place not in actual course of working and extension, and suspected to contain dangerous gas of any kind, shall be properly fenced across the whole width of such entrance, so as to prevent access thereto.

In every working approaching any place where there is likely to be an accumulation of gas, no lamp or light shall be used other than a safety-lamp.

Whenever safety-lamps are required by these regulations or by the special rules (in this Act mentioned) to be used, they shall not be used until they have been first examined and securely locked by a competent person, or persons, duly authorised for this purpose.

In any mine, or part of a mine, in which safety-lamps are required by these regulations or the special rules to be used, no person shall use powder or other explosive or inflammable substance for the purpose of blasting, or of getting coal or ironstone, except to the extent and in the manner authorised by the special rules.

Where a place is likely to contain a dangerous accumulation of water, the working approaching such a place shall not exceed 6 feet in width, and there shall be constantly kept a sufficient distance, not being less than 5 yards in advance, at least one bore-hole near the centre of the working, and sufficient flank bore-holes on each side.

Every underground plane on which persons travel, which is self-acting or worked by an engine, windlass, or gin, shall be provided (if exceeding 50 yards in length) with some proper means of signalling between the stopping places and the ends of the plane, and shall be provided in every case at one side or the other of such plane, at intervals of not more than 20 yards, either with sufficient man-holes (or places of refuge), or with a space (for a place of refuge) of sufficient length, and of at least 3 ft. in width, between the wagons running on the tramroad in the plane, and one side or the other of the plane, which man-holes or space shall be constantly kept clear.

Every level or inclined plane where the load is drawn by a horse or other animal shall be provided, at one side or other of the plane, at intervals of not more than *fifty* yards, either with sufficient man-holes or with a space of sufficient length and of at least *three* feet in width between the wagons running on the tramroad in the plane and one side or the other of such plane, which man-holes or space shall be constantly kept clear.

Every shaft or pit which for the time being is out of use, or used only as an air-pit, shall be securely fenced.

Every working and pumping pit or shaft shall be properly fenced, but this shall not be taken to forbid the temporary removal of the fence for the purpose of repairs or other operations, if proper precautions are used.

Every working and pumping pit or shaft where the natural strata are not safe shall be securely cased or lined, or otherwise made secure.

Every working pit or shaft shall be provided with some proper means of communicating distinct and definite signals from the bottom of the shaft to the surface, and from the surface to the bottom of the shaft.

A sufficient cover overhead shall be used when lowering or raising persons in every working pit or shaft, except where it is worked by a windlass or gin, or where the person is employed about the pump or work of repair in the shaft, or where a written exemption is given by the Inspector of the district.

A single-linked chain shall not be used for lowering or raising persons in any working pit or shaft, except for the short coupling-chain attached to the cage or load.

There shall be attached to the drum of every machine used for lowering or raising persons flanges or horns projecting sufficiently to prevent the rope from slipping off the drum.

There shall be attached to every machine worked by steam, water, or mechanical power, and used for lowering or raising persons, an adequate break, and also a proper indicator (in addition to any mark on the rope), which shows to the person who works the machine the position of the cage or load in the pit or shaft.

Every part of the machinery used in or about the mine near to which persons are liable to be employed, or to pass in the course of their employment, in or about the mine, and which may be dangerous to such persons, shall be securely fenced so far as practicable.

Every steam boiler shall be provided with a proper steam-gauge and water-gauge, to show respectively the exact pressure of steam and the exact height of water in the boiler, and with a proper safety-valve.

A barometer and thermometer shall be placed above ground in a conspicuous position, near the entrance to the mine.

If the owner or agent of a coal and ironstone mine acts in contravention of any of the foregoing regulations he shall be guilty of an offence against this Act.

#### OBSERVANCE OF REGULATIONS BY WORKMEN AND OTHERS.

If any person does any of the following things—namely,

Being in any place where a safety-lamp is required by this Act or by the special rules to be used, unlocks or wilfully damages any safety-lamp, or uses any safety-lamp which he knows to be defective;

Wilfully damages or without proper authority removes any fence, fencing, or casing provided in compliance with this Act;

Wilfully damages, or without proper authority removes or renders useless any means of signalling, signal cover, chain, flange, horn, break, indicator, steam-gauge, water-gauge, safety-valve, barometer or thermometer, or other thing in any coal and ironstone mine provided in pursuance of this Act;

Places anything in any place of refuge so as to prevent proper access thereto;

Fails to observe such directions with respect to working as may be given to him with a view to comply with the regulations respecting working contained in this Act or the special rules,

He shall be guilty of an offence against this Act.

Special rules are to be established in every coal and ironstone mine, as may appear best calculated to prevent dangerous accidents, and it is provided that existing rules at present in force shall remain so until varied by the Act. Provisions are made for the Secretary of State to object to special rules, for the amendment of special rules, and for posting up abstract of special rules at conspicuous place at mine. The owner or agent who fails compliance with this section is guilty of an offence against the Act, and any person who injures or defaces any abstract is also guilty of an offence against the Act. Notice of commencement and of abandonment of mines is to be given to the Inspector for the district within two months. Abandoned mines are to be securely fenced, and notice of all accidents is to be given within 24 hours. The arbitration clauses are nearly similar to those in the present Act, and similar powers are given to the Secretary of State for appointing Inspectors. The provisions as to coroners are slightly modified in the new Bill. It states—

With respect to coroners' inquests on deaths arising from explosions or accidents in coal and ironstone mines, the following provisions shall have effect :—

Where a coroner holds an inquest upon a body of any person whose death may have been caused by any explosion or accident, of which notice is required by this Act to be given to the Inspector, the coroner shall adjourn such inquest unless an Inspector, or some person on behalf of the Secretary of State, is present to watch the proceedings.

The coroner, at least four days before holding the adjourned inquest, shall send to the Inspector for the district notice in writing of the time and place of holding the adjourned inquest.

The coroner, before the adjournment, may take evidence to identify the body, and may order the interment thereof.

If an explosion or accident has not occasioned more than one death, and the coroner has sent to the Inspector of the district notice of the time and place of holding the inquest not less 48 hours before the time of holding the same, it shall not be imperative on him to adjourn such inquest in pursuance of this section, if the majority of the jury think it unnecessary so to adjourn.

An Inspector shall be at liberty at any such inquest to examine any witness, subject, nevertheless, to the order of the coroner.

Where evidence is given at an inquest at which an Inspector is not present of any neglect as having caused or contributed to the explosion or accident, or of any defect in or about the mine appearing to require a remedy, the coroner shall send to the Inspector of the district notice in writing of such neglect or default.

Any person having a personal interest in, or employed in or in the management of any mine in which an explosion or accident has occurred, shall not be qualified to serve on the jury by whom the inquest is held; and it shall be the duty of the coroner and constable, or other officer, not to summon any person disqualified under this provision, or allow any such person to be sworn or sit on the jury.

The penalties remain as in the Bill. Every owner or agent guilty of an offence against the Act is liable to a penalty not exceeding 20*l.*, and every person not an owner or agent, 2*l.* for each offence; and if the Inspector has given written notice of any such offence, to a further penalty not exceeding 1*l.* for every day after such notice that such offence continues to be committed. All notices under the Act may be served by post. Existing Inspectors are to continue in office, but are not, without further instructions, to inspect mines other than those they now inspect. The Acts 5 and 6 Vic., c. 99, 23 and 24 Vic., c. 151, and 25 and 26 Vic., c. 79, are to be repealed.

## Original Correspondence.

### THE UTILISATION OF SMALL COAL.

Sir,—I have just read, in the Journal of Feb. 5, a very interesting letter on the Utilisation of Small Coal, and, as the writer promises to call attention to anthracite coal in his next article, may I request the favour of him (or some other correspondent) to express his ideas how to make the best *fuel* from anthracite coal dust, or small—what quantity of pitch, in proportion to the weight of coal; and the most easy, inexpensive mode for compressing the fuel into bricks without machinery other than what may be made of *wood*, as a trial. It is such a valuable use to turn the refuse dust to that any information to render the matter practicable through the medium of the *Mining Journal* would be read with interest in many parts of the world.

*Oporto, Portugal, Feb.* 9. ——— George H. Hastings.

### PREVENTION OF COLLIERY ACCIDENTS.

Sir,—I shall endeavour in a few letters to lay before your readers not only the best means for the prevention of colliery accidents, but remarks on a subject that necessarily connects itself with them—the most approved appliances in operation for the proper working and raising of minerals to the earth's surface. As I am aware your columns are perused by many who, although connected with mines as shareholders, &c., are not acquainted with the practical working of them, I shall make my remarks as elementary as possible, as far as the explaining of technicalities, &c., is concerned, yet I hope they may be of some service to mine owners, managers, &c., by laying before them the best accessible means to suit their various requirements. I shall refer more especially to the coal fields in the centre of England, where the mines are comparatively shallow, lying, as a rule, between 100 and 200 yards from the surface. If we are to listen to some of our great geologists my task would be almost useless, as they predict with reference to South Staffordshire, one of the principal portions of the district mentioned, the exhaustion of the coal in a few years; but in this district geologists have been much at fault, they having asserted it to be almost impossible that coal could exist in various places where it has been lately found—such, for instance, as under the Rowley Hills. These discoveries will tend to lengthen the term of years over which the coal supply from this district will extend. The coal measures of South Staffordshire are in such a confused state that, speaking from past experience, I am convinced that geologists can form but a limited idea of the extent of coal yet unworked. I believe there is a vast tract of coal existing between the Western Boundary Fault of the South Staffordshire field and the Shropshire field. It is generally believed that in past times these fields were united, and the parting is attributed by some to convulsions, and by others to denudation; and there is every proof of the latter being the correct view, for on the Shropshire side they have driven through the fault, and found coal at some distance from the main field. The strata they have gone through show that the Permian sea has evidently flown over this portion of the country, and that the coal has been either washed away or taken down by the subsidence. Similar circumstances are shown in a heading driven into the fault at Himley, on the Staffordshire side; here the coal breaks off at a point or angle, and beyond it is found in a vertical position almost all the strata found in a horizontal position in sinking the pit shafts, before the Permians set in, indicating that the ground has very likely subsided after the sea had left, and so taken these measures down. Evidence is given of the presence of the sea on the Shropshire side, by the existence of clay and shells found in the grain of the coal where it is broken off. Now, if it is found that the coal does not exist in a much lower position beyond the faults, I am of opinion that the Permian sea has flown in the shape of a fork, and that a large tract of coal will be found, as it were, between the prongs, somewhere central between the Shropshire and South Staffordshire coal fields. I have wandered rather far from my original subject, to show that the fears of the immediate exhaustion of our coal fields in the Midland Counties are groundless. When the main measures of coal are worked out there are other thinner ones lying deeper, which may be worked by means of much improved appliances for winding and pumping, as seams of 12 and 14 inch coal are worked in Somersetshire. I will first give the best ideas for winding-engines to be adapted to various pits, connecting with them winding apparatus, breaks, &c. I shall then give the most approved chains or ropes in mining operations, then pit-frames, conductors, and cages, with all safety appliances to be attached thereto, the various means of conveying mine from the workings to the bottom of the shafts; and, lastly, means for ventilation, introducing the various improved safety-lamps. The original way for raising the mine was by means of an ordinary windlass, and a round hempen rope or chain, similar to that used at the present time for sinking; it may also be seen occasionally now in South Staffordshire raising coal where the depths are shallow. The first improvement was attaching gearing-wheels to the windlass, and working a small toothed wheel or pinion on the shaft, turned by hand, into a larger wheel on the shaft going through the barrel. By thus distributing the power two or three men were able to raise a much greater weight, but at a proportionate loss of speed.

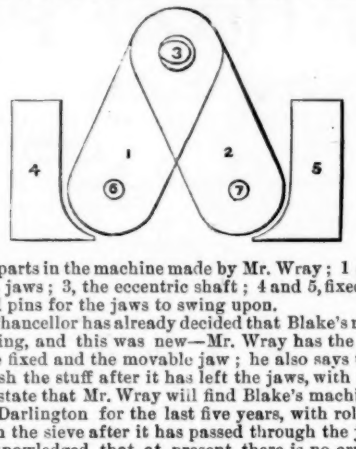
The next step in advance was the introduction of the "gin," consisting of a vertical drum, working fixed on a wood axis in a casting or block of stone at the bottom, and in a socket attached to a cross beam at the top, the cross-beam being supported at each end by ladder-shaped frames. A large horizontal beam, joined to the axis just below the drum, projects out on each side, and to one or both ends is attached a pair of shafts for horses. The horses when tackled to the shafts go round in a circle, causing the drum to revolve, and so wind and unwind the two ropes or chains upon it, which work into the pits over two small pulleys mounted on frames. These gins are in common use in many parts of Great Britain. Water has been used as a means for raising minerals, but with little success. The means adopted have been water-wheels and tanks. The water-wheels were supplied with two rows of buckets set opposite ways, to give the reversed motion for going up and down the pits; but this was improved upon by the use of toothed wheels, used as a reversing gear, so that the water-wheel could always revolve in the same direction. The water-tanks worked as an ordinary hydraulic lift, the tank when emptied of coal, &c., was filled with water, and made of a greater weight than the tank attached to it (by means of a rope or chain slung over the pulley), filled with coal at the bottom of the pit, which caused it, regulated by means of a break, to descend, and so raise the other tank; when arrived at the bottom the water was let out, and its place supplied by coal. The great step in advance was the introduction of steam as a motive power in raising minerals. The first engines used were condensing and high pressure, with beams, and also high pressure horizontal, all geared by means of pinion and crown wheel to the winding apparatus; in this way a large weight was lifted at a slow speed, by an engine of small power. This system may be seen in use at hundreds of pits in South Staffordshire, and answers very well where they raise the mine in skips, which are allowed to swing in the pit shafts. It is surprising that mine owners cling to these old-fashioned appliances; it is true with them, the first cost is less—for instance, a small engine is sufficient, and consequently much less brickwork is required, and as the speed is slow, they are able to have pit frames, &c., of less strength, and to do without conductors in pit shafts. But with all this it must be obvious that with an extra outlay at first, such as having a larger engine or engines, and using other applances I shall hereafter mention, a great saving of time and capital may be made. It must be borne in mind that if a small engine is used, and geared off, the same, in fact more, power has to be exerted, and the same amount of fuel used, to raise the mine to the surface as with a larger one, and with a greater amount of friction and wear and tear. I consider the best application of steam-power to mining operations, when the pits are between 200 and 300 yards in depth, to be by means of a pair of vertical engines, connected, having cylinders about 24 in. diameter, and working from 4 to 5 ft. stroke, the drum to be on the crank shaft with the fly-wheel in the centre, which also acts as the break-wheel. The drum is placed between the two engines, and supported on two wrought or cast iron girders, fitted into shoes, in each of the side walls of the engine-house, and also borne by four cast-iron columns, arranged two to each engine, and standing under the crank shaft carriages, which are placed one in the centre of each girder. The valves of the engines to be worked by a connected link motion, similar to that used in locomotives. The same class of engines may also be used placed horizontally, or a large engine may be used, direct-acting—that is, connected immediately to the winding apparatus without gearing. The great advantage gained in using two smaller engines instead of a large one is that as you couple them with the cranks at right angles you have no dead centre to overcome, for when one engine is at its least power the other is at its greatest. An engine is on what is called a dead centre when the piston is at either end of the cylinder, and the crank, connecting-rod, and piston-rod are in a direct line, so that until it is moved from this position it is almost impossible for it to act. This is of importance in a winding-engine, as the greatest amount of power is required at starting, when the load has to be lifted from the bottom of the pit, for, of course, as the load ascends there is a less weight of rope to sustain, and the balance—that is, the cage, &c., in the other pit—acts with greater power as it descends; and should the engine have stopped on or near one of these centres it would be necessary to take

it back a little to get a start. The advantages of having the engines vertical instead of horizontal are that they stand on less ground, and are consequently not so liable to be pulled about by the mining operations, and as the winding apparatus is overhead, the engine driver can stand in the centre of the two engines, and there is no drum to intercept his view of the pit mouths.

*Dudley, Feb.* 16. COLLIERY ENGINEER.

## CRUSHING MACHINERY.

SIR,—In noticing the crushing machinery erected by Mr. Wray, in the Supplement to last week's *Mining Journal*, it is described as being an apparatus of the stone-breaker class, which directs attention at once to its similarity to Blake's stone-breaker, the only machine made up to this time that has proved successful both for stone-breaking and ore crushing. Now, I have seen Mr. Wray's machine, as well as the plans of it, and it is clearly an infringement of Blake's machine—the only difference being that in the effort to make the similarity less evident certain deformities have been introduced which do not exist in Blake's stone-breaker, as usually constructed. The similarity will be seen from the subjoined section, which shows all




the essential parts in the machine made by Mr. Wray; 1 and 2 being the moveable jaws; 3, the eccentric shaft; 4 and 5, fixed jaws; and 6 and 7, fixed pins for the jaws to swing upon.

The Vice-Chancellor has already decided that Blake's machine was hopper-crushing, and this was new—Mr. Wray has the hopper also as well as the fixed and the movable jaw; he also says that he has rollers to crush the stuff after it has left the jaws, with reference to which I may state that Mr. Wray will find Blake's machine has been in use near Darlington for the last five years, with rollers to take the stuff from the sieve after it has passed through the jaws. I believe it is acknowledged that at present there is no crusher in use equal to Blake's, and I would suggest that if a double set of jaws be required it is better to use two machines.

I should have written you when the first notice of the machine made by Mr. Wray appeared in the *Mining Journal*, but I preferred, first, putting myself in correspondence with Mr. Wray, in the hope of preventing him from infringing my rights, without having recourse to unfriendly proceedings. I met Mr. Wray by appointment, went to see the machine, told him that it was an infringement, and that I should stop it: as he appears to be still determined to bring it before the public, I think it necessary to state in a few words what it is, and that I have endeavoured to avoid litigation.

*Soho Foundry, Leeds, Feb.* 16. H. R. MARSDEN.

## WHY IS COPPER SO LOW?

SIR,—Brokers' circulars inform us that the present price of copper is below anything previously known, and it seems to be very generally asserted that this extraordinary depreciation is solely due to excessive supply. If, however, it can be shown that our English seaport stocks were some years back larger than they are now, whilst prices were then quite 30 per cent. higher than to-day, it must, I think, be conceded that the *chief* causes of the existing depression are to be found elsewhere. Nor do I suppose that the force of this argument would be weakened by the recollection that at the time (1862) when these larger supplies existed the production of copper in the United Kingdom (which is so much English stock) was some 6000 tons (fine) per annum larger than it is now, whilst consumption was then smaller. I am unable to give the London stocks of copper in 1862, but the excess at that time in Liverpool and Swansea was sufficiently larger to counterbalance any probable deficiency both in the London and in the Havre figures. The stock of copper held in Liverpool and Swansea, in September, 1862, was as follows:—Ores, 12,113 tons; regulus, 29,660 tons; bars, 7867 tons; barilla, 720 tons; being equal together to about 25,000 tons (fine), against 19,000 tons now. The minimum price of Chili regulus in 1862 was 17*s.* per unit, and to-day it is 13*s.* The Swansea and Liverpool stocks, therefore, then represented in sterling about 2,125,000*l.*, against 1,250,000*l.* now. At 3 per cent. (the Bank rate at both dates) the interest charge would be 63,750*l.* per annum for carrying the 1862 stock, and 37,500*l.* for the present stock. Interest being almost the sole cost in holding copper, it follows that our present Liverpool and Swansea stocks are being held at not very much over half the cost of the supplies in the same ports in 1862. I purposely avoid any allusion to the supposed bareness now of trade stocks, as I believe that at the period of 1862 to which I have referred, both smelters and the trade generally were lightly supplied. The comparisons I have just made seem clearly to show that the present extremely low price of copper cannot, *in the main*, be ascribed to the largeness of existing stocks, whether these stocks be viewed by their actual extent, their money value, or by the present cost of holding. And as, moreover, there is at least one of our leading smelters who might *alone* (if he saw good cause to do so) grapple with *the whole* of the present Swansea and Liverpool stocks of ores, regulus, and bars, it seems strange to hear existing supplies spoken of as overwhelming. Viewing, too, the Liverpool and Swansea stocks, in conjunction with the country's annual requirements, we find that they are only equal to about three months' consumption and export, and this, too, at a time when smelters and the trade generally are supposed to be lightly supplied. It might further be stated here that the value of an imperishable import like copper ought in any case to be very much less influenced by large stocks than such imports as sugar, &c., which are liable to serious deterioration and loss in weight from holding.

Looking, then, at the question from all sides, I fail to discover in existing stocks any sufficient cause for the extreme depreciation of copper. The present extraordinary depression of prices proves, however, the existence of some acute disease. Can we discover its true diagnosis? I will now endeavour to show (as the question is of interest to most of your readers) where I think some of the most potent influences may be found. The chief inducing cause of the extreme depreciation I take to be the complete revolution which has occurred, and is still occurring, in the system of working the trade. We are passing from government by an oligarchy to a pure democracy in copper matters; and as in the political so in the commercial world, such transitions can seldom be effected without many sacrifices and much suffering. Ultimately, no doubt the copper trade will be benefitted by what is now taking place, but the process by which we are arriving at this desirable end is painful and distressing to copper producers, and to the trade in general. It is hardly worth enquiring now whether our smelters might have avoided, or at least delayed, the present revolution by the adoption of a more liberal and enlightened policy. It must, however, be a cause of deep regret to the producers that the transition was made at a time when all trade was being more or less affected by the great crisis of 1866, and an unfavourable political and fiscal condition in Europe and America, and when, too, an unusually large supply of old copper was being thrown on the market from our dockyards, &c., through the substitution of bronze for copper coinage. Whilst allowing, therefore, that our full seaport stocks have to *some extent assisted* in bringing about the present depression, I recognise the extreme depreciation as almost entirely due to a revolution in working the trade, the effect of which has been greatly aggravated by the want of confidence, diminished means, &c., engendered by the 1866 crisis, and the other causes to which I have just referred; and to understand what this trade revolution really means it is only necessary to allude to the very severe and distressing competition to which our smelters have been subjected by the large importations of Australian and Chilian ingots, and by the growing use of Chili bars among many of their largest customers. This serious interference with their trade has very naturally induced our smelters to conduct their operations with great timidity, and on a reduced scale; and the capital and credit of such a wealthy body cannot be even partially withdrawn from any trade without producing marked depression. But for this new state of things we should, probably, see copper prices to-day fully 10*l.* per ton higher than they are. It is useless, however, to dwell much on this point, as it seems impossible for the trade to go back to the old system. Having now, Sir, endeavoured to lay before your readers what appears to me to be the main cause of the exceptionally low price of copper, I propose in a subsequent letter to consider what seems to me to be the probabilities of the future.

INVESTIGATOR.

## MINING IN CARDIGAN.

SIR,—I have on several occasions endeavoured to draw attention to this subject in the columns of your valuable Journal, and will, with your kind permission, now resume my remarks.

There is a district in which is situated one of the oldest, if not the very oldest, mine in the county, which is very little known, except as being the site of the celebrated Cwmystwith Mine, the evident productivenes of which has lived not only in tradition for hundreds of years, but in the page of history, and for aught that man can show to the contrary, may continue to do so to the end of time. It is gratifying, however, to find that this highly-favoured mineral tract is not distined to be favoured by one mining company alone; as it appears the crown land opposite the Old Cwmystwith, known locally as "Graig Goch," has been secured by a highly influential party of capitalists. In this grant there are many lodes, and the advantages for working in the hill-side are of the first order; and judging from the general indications, and the famous productiveness of the parallel lodes in Old Cwmystwith, I think it a first-class speculation.

The next property in this district which seems to demand attention is the West Cwmystwith Mine, and if no other feature than that of having five or six lodes in a comparatively small space, all producing lead more or less, in a mountain giving a height on the lodes above the adit level varying from 50 to 100 fathoms, one would think these facts sufficient to command a vigorous development. But these are not all the favourable features of this concern. Here is a mineral property in a district second to none in the United Kingdom for the production of lead, upon which many thousands have been spent in cross-cutting the lodes, which have never been explored, and remain high and dry, ready to yield up their riches to reward the enterprising miner. The lodes in this grant are the same master lodes as traverse the old Cwmystwith Mine, and are here for near a mile in length. It may be said that in the old mine there are not only those master lodes, but a series of caunter and cross lodes, and that at the points of intersection of these several lodes the enormous riches were yielded. Be it so; and I answer the same phenomenon occurs in this grant. It may again be objected that in the old mine there is a channel of soft or decomposed clay-slate, and that the lodes at different points have come in contact therewith; and that although the lodes were severed thereby, and seemed to be deteriorated by the contact, it was not so, for the very severance itself of the hard vein by the soft was a provision in Nature to open the pores of the fissure to receive the promotive and life-giving elements distilled from the decomposed mother rock, and laid up for use, humanly speaking, in this great reservoir. Well, if this theory be true in the case of the old rich Cwmystwith, it is also true in the western property, for there is the same channel of ground in a decomposed condition, and while the greenstone dykes (or ironstone elvans) in this district are the very backbone and marrow, so to speak, of the mineral production here as elsewhere, the softer substances undoubtedly take a prominent part in the formation of the body corporate. There is not a feature, so far as I can discover, which might be considered favourable to the production of ore in the old mine which does not in equal strength exist in the western property.

Is there any doubt as to the highly favourable position of the property in relation to other mineral properties? Let those who doubt consult the Ordnance Map of the county, No. 57, section 6; find Cwmystwith, and immediately adjoining, to the west, will be seen the compound word "Pentrebumant," which is West Cwmystwith; and in a line still west may be seen the justly celebrated Lisburne Mines. Well, so much for its position; and now, what is the present condition of the property? Is it new? No. The lodes, six in number, on the south side of the mountain, are all discovered by a deep and other adits into the mountain, but never explored; they are drained, high and dry, for from 50 fms. to 100 fms. in height, and where opened are all productive of mineral, and the one upon which the present proprietors have operated is of a magnificent character; in fact, a more promising lode for a continuous yield of ore cannot be seen in this or any other country. I propose, with your permission, to refer again to this subject, and to add a tracing of the lodes, their several intersections, and their relation to the soft channel of decomposed mother-rock referred to.

*Goginan, Feb.* 16. RICHARD WILLIAMS.

[ADVERTISEMENT.]

## THE VIRTUOUS LADY MINE.

Lieut.-Colonel C. PERCIVAL requests the Editor of the *Mining Journal* to publish the following report on the Virtuous Lady Mine, which he believes will be agreeable to other adventurers in the mine, and the more so as he can vouch for the accuracy and carefulness of the inspection by Mr. G. M. Henty, of the Great Wheal Vor Mines.—*Handsworth Villa, Tavistock, Feb.* 16.

*Great Wheal Vor United Mines, Feb.* 14.—Having, as you desired, fully examined the Virtuous Lady Mine, both underground and at surface, I beg to hand you my report on the property. I have carefully reviewed the notes I made during my visit to the mine on two successive days, and am glad to say I have formed a favourable opinion on the prospects of the mine, which I feel satisfied will be borne out as the ground is more fully developed. I had an opportunity also of seeing the plans of the mine, which I learnt had been lately surveyed. By this means I was further convinced of the value of the property. The Virtuous Lady Mine is situated in the killas (clay-slate), in a beautiful valley at the junction of the rivers Tavy and Walkham, about 2½ miles south-west of Tavistock, and about three miles from the granite, a most advantageous position geologically for the production of mineral, and also economically for the development of the mine by water-power, which is quite sufficient to work any machinery that may be required, thus saving an enormous expense which would otherwise be incurred by the adoption of steam-power. The sett contains six known lodes, traversing within a few degrees of east and west, and varying from 1 to 40 ft. in width, which have all been, more or less, opened on. The present operations are confined to three lodes—the north, middle, and south lodes. In the eastern part of the sett these lodes will form a junction. This is a very desirable point to reach, and the engine-shaft is well situated about the centre of the sett, between the north and middle lodes, in a good position to command this ground. The north lode, bearing 24° south of east, is from 20 to 40 ft. wide, underlies south from 3 to 4 ft. in the fathom, and has been worked very extensively to a depth of about 13 fms. from surface, and about 100 fms. on the course of the lode; it appears to have yielded large quantities of ore. There are three tribute pitches now working on the lode at 12*s.* and 13*s.* 4*d.* in the stoping ground that has been left by former workers. There are some good courses of ore to be seen in the bottom of this level, which in all probability will become more valuable and extensive in depth. The engine-shaft, about 8 fms. south of the north lode, is sunk 20 fms. from surface, and is now being cleared to resume sinking; when about 4 fathoms deeper this shaft will intersect the Bedford lode, and in the course of further sinking will meet with the north and middle lodes. The middle lode underlies north towards the north lode, bearing 9° north of east. There is an end driving west towards the boundary at 13*s.* 4*d.* in 1*l.* tribute, producing about 3 tons of ore per fathom. There are also two other tribute pitches working in this part of the mine, at from 12*s.* to 13*s.* 4*d.* in 1*l.* This lode is about 20 ft. wide, and has been largely worked by an adit to a depth of 15 fms. from surface, which is driven on the lode a distance of 150 fms., and 40 fms. back from the end there is a cross-cut driven about 15 fms. to cut the south lode, about 50 fms. in advance of the end, and about 3 fms. deeper; from the appearance of the ground in this cross-cut I think the lode must be very near. I may here remark that these, like most other large lodes, contain horses of killas, which, however, are more or less mineralised, and such appears to be the case in this mine. The south cross-cut is 8 fathoms deeper than the adit on the south lode, and the cross-cut would reach the lode with 25 fms. backs. The south lode, about 7 ft. wide, has also been considerably worked at a shallow depth, where the lode is composed almost entirely of gossan, with the black oxide of copper; this lode has also a promising appearance for yielding copper ore in depth.

All the lodes in this sett have good gossan backs, with a considerable quantity of the black oxide of copper, mixed with chloride, which I consider a most favourable indication. The back of a large elvan course may be seen a few fathoms east of the boundary, which is also an important feature. There is a new 32-ft. water-wheel, 3-ft. breast, attached to flat-rods working an 8-in. lift in the engine-shaft, where they will soon prepare to fix the first plunger preparatory to sinking; there is also a crusher on the mine about to be erected, with other plant. In conclusion, I beg to say I have every reason to believe that this property will, if worked judiciously, before long yield a most profitable mine.—*G. M.* HENTY.

[ADVERTISEMENT.]

## THE VIRTUOUS LADY MINE.

SIR,—Although it may take us another two or three weeks, still we may at any hour cut the great north lode; the end is highly mineralised, and it is the opinion of all who have seen the mine that the chances are strongly in our favour we shall meet with an immensely rich and lasting course of ore. The pitches are looking well, surface operations progressing slowly enough, but as fast as the weather will permit; however, six weeks or two months will, I believe, enable us to go to market with 1500*l.* worth of ore, and you will find that before the end of this year I shall be able to proclaim to the world, and no one will contradict it, that we have (not are going to have) the richest and most profitable copper mine in England. The world may think what it likes, but depend upon it the Virtuous Lady Mine will be greeted with smiles and blessings in the future, when half the mines now working will receive naught but smothered curses. This is genuine, and from the heart, as are all my statements; and, mind you, it is not to dispose of shares, as I am no seller.

BRENTOR MINE.—Your readers will observe the prospectus of this property in one of your columns. I am somewhat unconcerned as to the disposal of these shares; the list will be opened for three weeks, when it will be closed, and allotment made, and should sufficient capital be not raised it will not matter, as having faith in the property I am quite willing to work it by myself; however, it strikes me very forcibly from the applications I have received before the appearance of the prospectus in the Journal that the shares will be all taken up in three or four weeks. THOS. J. BARNARD.

*5, Abbey Mead, Tavistock, Feb.* 17.

[For remainder of Original Correspondence, see this day's Journal.]

BOSCASWELL MINE.—A few years ago this concern was for sale. Its mineral was thought to be exhausted, and the price of tin was so low that speculation in a mine of 180 fms. deep, that had been abandoned by its adventurers, was generally considered out of the question. Guided by the views of Capt. Eddy, who knew the ground well, and backed by the good wishes of the neighbourhood, Messrs. E. S. Boyns and J. T. Kevern, of Penzance, bought the whole concern for 2000*l.*, and at once prepared to lay out and prosecute the mine for a permanency. They have cleared up, and out, places underground, added stamping-power, increased their workpeople from 30 or 40 to 120, are driving and sinking in a miner-like way, and paid on Saturday, in wages alone, between 400*l.* and 500*l.* The mine is raising about 10 tons of tin a month, a quantity soon, it is hoped, to be increased to 12. Messrs. Boyns and Kevern are the sole proprietors, have had a full share of hard work and wearing anxieties about this mine, and well deserve the success all wish them. It will at once be seen how to a speculation of this kind—to the proprietors, to the agents (Capts. Eddy and Noy), and to the little community of workpeople—a rise or fall of 5*l.* a ton on tin becomes all-important.

## FOREIGN MINING AND METALLURGY.

There is no very material change to note in the French iron trade. The returns of the importation by warrants of iron, pig, and plates, into each French department during the first eleven months of 1869 make up totals of 60,165 tons of pig, 24,674 tons of iron, and 3347 tons of plates, as compared with 43,679 tons of pig, 18,870 tons of iron, and 3346 tons of plates during the corresponding period of 1868. We find the following passages in the last bulletin of the French Committee of Forgemasters:—

"The committee has hitherto avoided speaking of the complaints which French metallurgists have had to make against the great French railway companies. These two industries, which have so many points in common, and which lend constantly a mutual assistance to each other, owe each other reciprocal regards. A uniformity and a reduction of transport tariffs has become for French metallurgy a requirement of the first order. We do not raise any doubts as to the strict rights which the railway companies can oppose to the complaints of the forgemasters; but we cannot forbear citing an example which proves how inadequately the interests of French producers are satisfied by the present state of our tariffs. A great forge of the Moselle, which enjoys a common tariff on the Eastern and the Orleans systems, cannot forward its products into the ports of the West of France for less than 1*l.* 8*s.* per ton, while in the case of deliveries made to Vienna (Austria)—an equal, if not a greater, distance—the rate of transport only amounts to 1*l.* 4*s.* per ton. The French producer thus finds himself in a better position in respect to tariffs on the German lines than on the lines of his own country, and it is more to his interest to supply foreign companies than those of his own nation. This is a state of things with which French railway companies do not sufficiently concern themselves." Steps are being taken to re-organise and re-constitute the great French mechanical concern known as J. F. Cail and Co.; further progress will be reported in the matter early in the summer, but a good deal still remains to be done in the way of maturing the necessary arrangements.

As regards Belgian matters, we may note that a new undertaking has been formed, under the style and title of the Vigsnaes Belgian Mineral Company. The promoters and directors of the concern are M. Edmond Lambrechts, M. de Roubaia, M. Adolphe Lambrechts, M. Oedenhoven, and M. Martin Bernstein. Certain modifications have been introduced into the statutes of the Pieton Central Colliery Company. With the return of the spring somewhat more activity is hoped for and anticipated in connection with Belgian metallurgy. As has been already stated upon more than one occasion, there is a good deal doing now, but still Belgian metallurgists begin to cast about for fresh orders. There seems every probability of another year of unbroken European peace, and this being the case further requirements for railway plant can scarcely fail to arise in connection with the vast railway works in execution or projection in Russia, Austria, Hungary, and other parts of Europe. Russia especially is very busy at present in the matter of railway development, and the energy which is being displayed on the subject is reflected in the fact that one section of the Moscow and Jaroslaw line has been opened for traffic. The Moscow and Jaroslaw, it will be remembered, was only projected so recently as the autumn of 1868; a portion of the capital—and no inconsiderable portion either—was subscribed in England.

The sale of coke has attained for some time past remarkable proportions in all the Belgian basins; the production is insufficient to meet the demand, which appears to be continually increasing, and attention is being seriously given to an augmentation in the means of production. At Liége, as at Charleroi, it is proposed to light shortly furnaces, the construction of which is being pushed vigorously forward. Prices are maintained with a firmness which seems to indicate that the advance has not yet been carried to its ultimate point. Roasted coke is quoted at 1*l.* per ton at Mons; for unwashed the quotation is 17*s.* 6*d.* per ton. The state of the Belgian coal trade remains good, and without material variation, neither in the tone of prices, which remains as hitherto, nor in the general aspect of the market, which continues to receive a very regular current of orders, as well from abroad as from Belgium itself. Everywhere the extraction is extremely high, and yet no stock is formed anywhere. If deliveries could be effected without difficulty the present state of affairs would leave little or nothing to be desired; and even as regards deliveries there is now less embarrassment than there was some weeks previously. The dividend of the Belgian General Company for Promoting the National Industry has been fixed for 1869 at 3*l.* 4*s.* per share.

Favourable advices continue to come to hand from the coal basins of the departments of the Nord and the Pas-de-Calais. The coal raised is taken off as fast as it is extracted, and the proprietors of mines do not show any disposition to enter into contracts for long terms in advance, as they fear that they may not be able to fulfil them, the extraction being pushed to its utmost limits, and order books being well filled. Previous quotations are, it is needless to add, maintained with firmness under such circumstances as these. Upon the Paris market a revival in affairs has been observed, and at the last dates there was considerable activity in transactions. The state of the Paris market would be excellent were it not that certain fears are inspired in the minds of industrials with reference to arrangements as to the octroi duties. Trucks are no longer wanted, but, on the other hand, there is a certain scarcity of supplies. With regard to the French iron trade, it may be observed that the Champagne market has presented rather more activity during the last few days. Transactions in merchant iron, without being very active, seem to be more sustained; some works have also received several orders for special iron; machine iron maintains an excellent position.

It appears that the Northern of France Railway Company intends to employ Bessemer steel rails on a great scale. The company, instead of laying down iron rails of about 75 lbs. per yard, will use Bessemer steel rails of about 60 lbs. per yard; the cost of the steel rails will, it is estimated, however, be one-fifth more, notwithstanding their relative lightness, than that of the iron rails. The Creusot Works are making arrangements, however, to produce Bessemer steel on a large scale, and probably its cost will thus soon be cheapened.

At Rotterdam, transactions in Banca tin have taken place at 64½ fls. As regards Billiton, there is scarcely anything on the market. At Amsterdam, the disposable stock of Banca having become much reduced, holders have endeavoured to carry quotations to 64 fls., but the effort was vain, confidence being greatly wanted in affairs generally. As regards Billiton, nothing of interest has transpired at Amsterdam; the deliveries in January of this description were almost *nil*. At Havre, Chilian in bars has made 68*l.* 8*s.* to 69*l.*; refined ditto, in ingots, 73*l.* 4*s.* to 73*l.* 12*s.*; Peruvian mineral (pure standard), 70*l.* to 70*l.* 10*s.*; United States (Baltimore), 76*l.* to 78*l.*; ditto Lake Superior, 80*l.* to 86*l.*; Mexican and La Plata in bars, 66*l.* to 68*l.*; old yellow copper, 44*l.* to 48*l.*; red ditto, 66*l.* to 68*l.*; and bronze, 65*l.* to 68*l.* per ton.

## FOREIGN MINES.

ST. JOHN DEL REY.—The directors have received the following report, dated Morro Velho, Jan. 17:—Morro Velho produce for December, 9585 oits., from 3683 tons of ore; yield, 2·602 oits. per ton. Morro Velho cost for December, 3878*l.*; loss for December, 770*l.* Morro Velho produce for 11 days of January, 2392 oits.; yield, 1·865 oits. per ton. Gaia produce for December, 490 oits., from 844 tons of ore; yield, ·580 oits. per ton. Gaia cost for December, 485*l.*; Gaia loss for December, 275*l.* Gaia produce for 11 days of January, 155 oits.; yield, 1·140 oits. per ton.

DON PEDRO NORTH DEL REY (Gold).—Mr. F. S. Symons, in his report for December, states that the produce amounted to 5745*l.* 3*s.*, and the cost to 2579*l.* 8*s.* 1*d.*, showing a profit of 3165*l.* 14*s.* 11*d.* Mr. Symons also mentions that "an unusually heavy fall of rain cut up the roads so badly that the transit of timber was much affected. A line in No. 6 rising west has given some splendid work. Produce exceeds that for November by 3587 oits., and we are enabled to show a profit of above 3000*l.* sterling." First division of January—Extract from Mr. F. S. Symons' letter, dated Jan. 17:—Produce weighed to date 4256 oits. Mine operations are progressing. Line in No. 6 rising west continues to give fair box work. Nothing is doing in stopes in curve or sump shaft, owing to water. We hope to get horse-engine to work by end of week, as iron shaft from foundry has arrived, and will then prosecute sinking Vivian's shaft with vigour. Carmen are again commencing to work, and I hope soon to have a good stock of timber. Ground in Treloar's is favourable. New middle adit was commenced to-day. I have great pleasure in reporting that auriferous ground has been struck in Alice's west. We are opening on it as fast as possible. It will, I hope, turn out of first-rate importance to the company.

ANGLO-BRAZILIAN.—Mr. F. S. Symons, in his report for December, states that the produce for the month amounts to 4188 oits. (483 ozs. troy), leaving a profit of 364*l.* 12*s.* The standard of the stone treated is better than in last month. By special efforts a supply of stone was arranged by the stamps during the Christmas holidays.

GENERAL BRAZILIAN.—The operations at the mines to the end of December having consisted, as before advised by Capt. T. Treloar, of erecting buildings, repairing roads, and other preparatory measures, no special report has been forwarded for the month, but Capt. Treloar has sent a *resume* of the operations for the year 1869. This is now being printed, and will be sent to the shareholders, with the accounts for the annual meeting, to be held in March.

TAQUARIL.—The report for December states that notwithstanding unfavourable weather during the first half of the month, and holidays at latter part, attendance of force has been good, and amount of work accomplished satisfactory. The cross-cut from the engine-shaft reached Old Mine on the 30th, since when a rise to surface for ventilation has been in hand. The excavations, or as much as can at present be seen of them, have fallen together. The erection of the wheel is in an advanced state, and all other works connected with pumping machinery are progressing apace. The whole will, we expect, be ready by the end of March.

ROSSA GRANDE.—Mr. Ernest Hilcke's report for December states that the produce for the month amounted to 1830 oits. (equal 211 ozs. troy), derived from 162 tons of ore, averaging 11·3 oits. per ton. In the first division of January the report states that the operations are progressing steadily, and

force is coming in more freely. A communication has been opened from the end of the 60 fm. level to the 56 fm. level; the lode here is again improving in size, and it is expected by opening out on it to meet with some good stoping ground. The sinking of the shaft has been resumed, and a good looking lode has been intersected, but we have to see more of it before its size and value can be ascertained. Owing to a little increase of force we resumed the operations at the Cachoeira Mine; the works here are progressing very satisfactorily. The operations at the western exploration of Gonço Mine have been carried on with good speed, but the proceedings have not led to any discovery of interest, nor to anything worthy of particular observation.

BRAGANZA (Gold).—The directors have received the following advice from their superintendent, Mr. W. H. Richards, dated Rio Janeiro, Jan. 22, and telegraphed from Lisbon Feb. 15:—"Cut a rich vein in Morro Tabac (the company's mine), yielding 8 ozs. of gold per ton."

Since the above telegram was received, letters have come to hand from Mr. Richards, the company's superintendent, confirmatory of the statement therein.

SAO VICENTE.—Capt. Martin, Jan. 1: Jacotinga Formation: The No. 2 cross-cut has been extended in the past month 4 fms. 5 ft., and properly secured with timber. The strata are principally yellow clay and sand, mixed with iron. Smith's cross-cut has been extended during the month 5 fms.; the ground is favourable for exploring, but the air very light; this level is driven into the mountain altogether 79 fms. We have put the men to drive west on a bed of jacotinga, but the samples have not as yet shown gold. The level on the south side of the mountain has advanced during the month 6 fms. 2 ft. We continue to intersect jacotinga in this level, and some of the lines look favourable, but the samples, which we are very careful in selecting, have not discovered gold.

ANGLO-ITALIAN.—The directors have received a report for January from Mr. Pearson Morrison, from which the following is an extract:—"Everything is going on satisfactorily; the progress not quite so much as I should wish, occasioned by the intense cold, which, up to the present, has excluded every possibility of finishing our surface works. This delay, however, will not occur again, for by next winter we shall be well under cover both at mines and reduction-works."—[Shareholders can see the samples of gold brought over by Mr. Morrison at the company's office.]

EXCHEQUER.—Jan. 17: The preliminary operations are not quite finished. The chamber over the proposed shaft is well on, and the drift between the old and new tunnels started on the Saturday previous, are not so far on as was expected. This drift is run to get the car way around the shaft, which is to be sunk in the new tunnel, where the ore was got out. If the weather keep moderate, so that sleighing can be done, I will redeem my promise. From several places in the tunnel I took specimens of ruby silver ore, and what between my chance in the face, 50 ft. in the shaft, and another place found yesterday, it beats me if I do not show you the colour.

IMPERIAL SILVER QUARRIES.—Lewis Chalmers, Jan. 17: We are now in 136 fm., having made 12 ft. last week, and 10 ft. the week before.

NEW WILDBERG.—J. Sanders, Feb. 11: East Mine: The drivage east at the Erbstollen is composed of schiefer, grauwacke, and quartz, with a slight mixture of lead ore, yielding of the latter about ½ ton per lachter, with the appearance of further improving.—Carter's Shaft: The drivage and stopes time past, yielding 1¼ ton of ore per cubic lachter. The rise and stopes above the 60 lachter level, towards Johannes' sink, are yielding 1 ton of ore per cubic lachter; and the stope above the same level, east of Michael's shaft, 1 ton per lachter. The stopes above the 50 lachter level, on the Dornergang Erzkammer, are yielding, on an average, 1 ton per cubic lachter. The tribute pitch on the Gotteshilfe is not quite so good as last week, the value being 1 ton per lachter.—Beck's Workings: The men have commenced another stope in the back of the 70, where the lode is worth 1 ton of ore per lachter at present, but is expected to improve as we get higher above the level.—Blumengang: The stope above the 70 is yielding 2 tons, and the stope above the 60, 1¼ ton per lachter. All other parts of the mine are much as usual.—West Blumengang: The water is sunk 68 lachters. We have this day sampled January ore (computed) 70 tons, which is offered for sale on the 21st inst.

PESTARENA UNITED (Gold).—T. Roberts, James Mitchell, Feb. 10: The 46 end, south from Aquavite engine-shaft, has further improved, yielding now 7 tons of ore per fathom, worth 15 dwts. of gold per ton. All other points at Pestarena are much the same as when last reported.—Val Toppa: The principal stope on the flat lode above No. 2 level is yielding now 10 tons per fathom, worth 1½ oz. of gold per ton. All other stopes and ends are yielding the same as last week.

LUSITANIAN.—Feb. 8: At Taylor's engine-shaft, below the 130, the lode in the stope is 8 ft. wide, composed of quartz and flookan, with a branch of ore, worth 2 tons per fathom. In the winze No. 80, below the 120, east of Taylor's, on Basto's, the lode is worth 2 tons per fathom. In the 130, east of Taylor's engine-shaft, the lode is worth 3 tons per fathom. In the 130 west the lode is worth ½ ton per fathom. In the 120 east the lode is 2 ft. wide, composed of quartz and stones of ore. In the 90, east of River shaft, the lode is 2 ft. wide, composed of flookan and quartz. In the 70 east the lode is worth 1 ton per fathom. In the 28, east of cross-cut, west of Perez' shaft, the lode is 1 ft. wide, worth ½ ton of ore per fathom. In the 18, west of cross-cut, west of Perez', the lode is 6 in. wide, producing very good stones of ore. In the 18, east of cross-cut, west of Perez' shaft, the lode is 1 ft. wide, composed of country and flookan.—Carvalhal: At the incline below the 50 the shaft has no lode in it to value. In the 50, east of incline, the lode is 1½ ft. wide, composed of quartz, with stones of blende and spots of lead. In the 50 west the lode is 30 ft. wide, composed of quartz and stones of blende. In the 40 east the lode is worth ½ ton of lead per fathom. In the 30 east the lode is worth ½ ton of lead per fathom. In the 20 east the lode is 1 ft. wide, composed of quartz. In the 10 east the lode is worth ½ ton per fathom. In the adit level, west of incline shaft, the lode is worth ⅜ ton per fathom. In the 10 west the lode is 2½ ft. wide, composed of quartz and stones of copper ore.

WEST CANADA.—My last report was forwarded to you on Feb. 1. I now beg to hand you the setting list for January, and the following report of our proceedings:—Huron Copper Bay, Stephens's Winze: The men have finished the necessary timber work required at this place, and will proceed with the sinking on Monday next. The lode in the stope east of this winze, below the 20, is still large and coarse; it yields at this time 2¼ tons of ore per fathom. The stope in the bottom of the 20, west of Palmer's shaft, is worth 2 tons of ore per fathom. The stope east of this shaft, below the 35, is improved since last reported on; it now yields 2¼ tons of ore per fathom. The stope on the west of Powell's winze, on the fire lode, below the 20, is worth 2 tons of ore per fathom. The lode in the level west of this stope became so poor after driving on it a few feet that we were obliged to suspend it. The stope over the 35, east of Bray's, yields 3½ tons of ore per fathom. The stope below the 35 is worth 3 tons of ore per fathom. The 60 fm. level, driving west, yields 1 ton of ore per fathom; the hardness of ground has made this level very slow for driving, but it has now become much easier for breaking; we are now making good progress, and hope to hole to Palmer's shaft in the course of a week. The 60 fm. level, east of this shaft, is very poor and unproductive. We cannot say much about the value of the lode in the 50, west of Palmer's, at present, as the level is driven on the north part of the lode. Bartle's winze, sinking below the 50, east of Bray's shaft, yields 2½ tons of ore per fathom for the length of the winze.—Wellington Mine: The stope east of Rowe's saaft is worth nearly 3 tons of ore per fathom. The stope west of this shaft is worth 2½ tons of ore per fathom.

LINARES.—Feb. 2: West of Engine-shaft: The lode in the 85, west of Warne's engine-shaft, is large and easy for driving, but does not contain any ore. In the 75, west of Crosby's shaft, the lode is hard and small. The lode in the 55, west of San Francisco shaft, is compact and regular, and of a kindly appearance, yield ¾ ton of ore per fathom. The 55, east of this shaft, produces 2 tons of ore per fathom; this has opened a great length of fine ore ground in the past month; the lode is not now so good in the bottom of the end. In the 45, east of this shaft, the men are put to cross-cut north, to prove a branch of the lode standing in that direction. The lode in the 31, east of San Francisco shaft, is very regular, but does not contain lead enough to value. In the 25, east of this shaft, the men are cross-cutting towards a branch standing to the north of the present workings.—Shafts and Winzes: In San Francisco shaft, sinking below the 55, the men are making satisfactory progress, considering the hard nature of the rock. No. 170 winze, below the 55, is going down in a strong, compact, and productive lode, worth 2 tons of ore per fathom. No. 172 winze, below the 31, also yields 2 tons per fathom; this is in advance of the 45 end, and in a very pretty lode. The stopes produced the usual quantity of mineral in the past month, and have only undergone the ordinary changes. We estimate the raisings for February at 275 tons. The machinery is in very good working order, and all surface operations are going on regularly.—Los Quinientos Mine: The 45, west of Taylor's engine-shaft, produces 4 tons of ore per fathom; this has opened a good length of rich ore ground in the past month. The lode in the 45, east of Taylor's, continues quite unproductive. In the 32, west of Cox's shaft, the men are getting on well in cross-cutting south. The 32, east of Addis's shaft, yields 1 ton of ore per fathom; the lode is very irregular; it occasionally produces rich lumps of ore. The 32, west of San Carlos shaft, yields ¾ ton per fathom; the lode is looking much more kindly than it has for some time past. The 32, east of above shaft, is in old works, which are gone below the level.—Shafts and Winzes: The men are getting on remarkably well in sinking Taylor's engine-shaft below the 45. Excellent progress has been made in sinking San Carlos shaft below the 32 in the past month. The deepening of Henty's shaft below the 20 is going on very regularly. In Sanches' winze, below the 32, the lode has failed in the last few days. Cabrera's winze, below the 32, yields 1½ ton per fathom; the lode continues very compact and strong in this sink.

FORTUNA.—Feb. 1: Canada Incosa: The 110, driving west of O'Shea's shaft, is in very hard ground, and the lode is small. The 110, east of O'Shea's shaft, yields 1 ton of ore per fathom. The lode is large, composed of carbonate of lime, quartz, and lead ore. In the 100, west of Henty's shaft, the ground is easy for driving, and the lode large and open, yielding ½ ton of ore per fathom. The 90, west of Judd's, also produces ½ ton of ore per fathom. The lode is small, with a good stone of lead in the bottom of the end. Since last report the lode in the 80, west of Judd's shaft, has fallen off in value, and become very small, yielding ½ ton of ore per fm. The ground in the 80, south of Henty's, still continues favourable for driving. The lode in the 50, east of San Pedro shaft, is large, composed of quartz and stones of lead ore, yielding of the latter ¼ ton per fathom. The 90, east of Addis's shaft, is worth 1 ton of ore per fathom. Since last report this end has passed through a very fine, strong lode, and still looks very kindly. The 80, west of Lownde's shaft, yields ¾ ton per fathom. This end is not looking quite so well as it was. In the 80, east of Lownde's shaft, the lode is large, and letting out plenty of water, but does not contain enough lead to value. The lode in the 170, east of Carro's shaft, contains a few spots of lead in the part of the lode we are driving on, but not sufficient to value. The 45, east of San Tomas shaft, is unproductive.—Shafts and Winzes: The ground in O'Shea's engine-shaft, sinking below the 110, is still hard and difficult to sink. Cayetano's winze below the 50 produces 1½ ton of ore per fathom.—Los Salidos Mine: In the 100, west of Beunos Amigos shaft, a favourable change has taken place, and the lode now yields 1¼ ton of ton per fathom. The 20, west of this shaft, although poor at present, has been opening good ground in the past fortnight. The 75, west of San Carlos shaft, yields 1¼ ton per fathom. The lode is open, and the ground somewhat easier for driving than it was. The 100, east of Cox's shaft, is also worth 1½ ton per fathom. The lode is not so large as it has been, and the ground is much harder for driving. The 90, east of San Pablos shaft, produces 3 tons of lead ore per fathom. The lode is large and strong, composed of quartz and lead ore. We have resumed the driving of the 75, east of San Miguel shaft. The lode is rather small, yielding ½ ton per fm., and the ground hard.—Shafts and Winzes: The lode in Morris's engine-shaft, sinking below the 100, contains good stones of lead at times. We have secured Palgrave's engine-shaft with mason work, and shall now change the pitwork, and get on sinking as fast as possible. San Miguel shaft is now communicated with the 75. Pardo's winze, below the 90, yields 1 ton of ore per fathom. The lode in the west end of th's winze is worth 3 tons of ore per fathom, but the bottom is not so good. Salina's winze, sinking below the 75, is worth 1½ ton per fathom. The lode is regular, compact, and solid, but not so valuable as it was.

[For remainder of Foreign Mines see to-day's Journal.]

## ENGLISH AND AUSTRALIAN COPPER COMPANY.

**The ordinary general meeting of shareholders will be held at the London Tavern, on Tuesday next.**

The directors' report will state that the gross quantity of ore delivered to the works by the South Australian Mining Association during the year ending June 30 was 2898 tons 8 cwts. in 1868-69, against 4116 tons 1 cwt. in 1867-68. The gross quantity of ore, regulus, and rough copper received from other mines was 2467 tons 16½ cwts. in the year ending June, 1869, against 2006 tons 2 cwts. in the previous year. The quantity of ore smelted at the Burra Burra Smelting Works was 1866 tons 20 cwts., against 1368 tons 7 cwts. in the preceeding year. The quantity of ore and regulus smelted at the Port Adelaide Smelting Works was 2921 tons 5 cwts., against 4272 tons 15 cwts. in the year ending June 1868. The quantity of copper made at the Adelaide Smelting Works was 2360 tons to June, 1869, against 1676¾ tons to June, 1868; this was the total quantity of copper made at the Adelaide Works in the periods mentioned. The quantity of copper shipped from South Australia during the year was 1219 tons 15 cwts., against 1276¾ tons in the preceding year. No ore has been raised from the Burra Burra Mine since Jan., 1868. Mr. William Swanborough, whose services had been secured to conduct the system of open working at the mines, left England last August, with a considerable portion of the necessary machinery; and on his arrival the operations recommended by Mr. Darlington would at once be commenced. According to the last advices from Adelaide, it was expected that ore would again be raised about April next.

In spite of numerous difficulties inseparable from the construction of works of this character, the progress of the new wharf has been satisfactory during the past half-year. Out of a total number (124) of iron piles required, 82 have been screwed into position, 26 part screwed, the caps and other iron-work fitted, and a portion of the timber work done. The engineer in charge estimates that the whole of this part of the work will be completed by the end of the current year. Some delay and increased cost have been caused by the failure of the South Australian Government to carry out their promise of dredging the channel leading up to the river frontage; but, by the last advices, a positive assurance had been given that this should be pushed forward immediately.

Already, by means of a temporary staging, two ships have been discharged at the new portion of the wharf.

From Newcastle (Dec. 3), Mr. Hamilton reports the arrival of the Ambassador from England, with the principal part of the materials requisite for commencing operations. He has engaged Capt. Christoe as superintendent, who was daily expected; it was hoped that by the end of April fires would be lighted. He was more than ever impressed with the great advantages which would arise from the cheaper means of smelting afforded by these works, and in this view the board fully concur.

In consequence of the altered condition of the company's traffic, owing to the completion of the railway the whole distance from Port Adelaide to the Burra district, the farms and land, the teams, cattle, &c., are no longer required for the company's operations in that quarter, and precise instructions have been furnished to Mr. Hamilton to dispose of these on such conditions as may be the most advantageous. A portion of the horses and farm stock has been already sold, showing a considerable loss upon former valuations, as many of the horses and mules had been in the company's service for a great number of years. In the report on these properties, by Mr. Hamilton, the board were advised that a large deduction would have to be made from the estimated value, as it stood in the accounts of the company. The board have not carried this depreciation to the general statement of profit and loss for the current year; but propose, when the whole of the land and teams and farming stock are disposed of to fully report upon them to the shareholders in the accounts closing June 30, 1870. The money derived from the sale of these properties will be employed in the erection of the works at Newcastle, and the completion of the wharf at Port Adelaide, both of which the board regard as works of the highest importance, and which, they believe, will in the future prove of lasting advantage to the company.

The accounts for the year ending June 30, 1869, show a heavy loss, both on the operations of the year and on the valuation of copper stock on hand on June 30, 1868. The causes are considered exceptional, and not likely to occur again. The reserve fund after deducting 6000*l.*, written off the losses of the year, and adding interest to Dec. 31, 1869, amounts to the sum of 6754*l.* 12s.

[For remainder of Meetings see to-day's Journal.]

STEAM-BOILER EXPLOSIONS.—The number of explosions that occurred during the year 1869 throughout the country was 58, by which 86 persons were killed, and 126 others injured, while if to this be added the two kitchen boiler explosions and the two tar boiler explosions, the return for the year 1869 will be 62 explosions, resulting in 93 deaths, and 130 cases of injury. Explosions clearly are not on the decrease. The estimate is that one steam-boiler explodes every week, or in round numbers 50 explode every year, killing 75 persons. More explosions occurred, as in previous years, at collieries, mines, and iron works than at any other works, while those at iron works were of a much more fatal character than those either at mines or collieries. Numerous as cotton and woollen mills are, only one occurred at a cotton mill and one at a woollen mill. More explosions arose from, and more persons were killed by, the plain cylindrical externally-fired class of boiler than any other. The introduction of the internally-fired Lancashire boiler in the place of the plain cylindrical externally-fired would certainly be productive of safety, and it is thought of economy. All boiler explosions may, as a rule, be attributed to the neglect of the boiler maker, the boiler owner, or the boiler minder.

GEOLOGY AT KING'S COLLEGE.—We have much pleasure in noticing the appointment of Dr. DUNCAN to the Chair of Geology at King's College. Dr. Duncan has for some time past filled the office of one of the secretaries to the Geological Society in an efficient manner, and has contributed papers to that society, replete with practical suggestions and information on important palæontological points connected not only with descriptions of new forms, but in their bearings on the conditions under which certain strata were deposited.

COAL IN BRITISH AMERICA.—The property of the Intercolonial Coal and Railway Company, in Nova Scotia, comprises four square miles of coal areas, held under the laws of Nova Scotia, and containing, according to the calculations of Prof. Leslie, 150,000,000 tons of superior coal. The Professor further calculates that the quantity of coal in the coal areas is sufficient to last 250 years, even should 500,000 tons per annum be exported. The coal areas of the company are situated on the sea coast, but there being no good natural harbour nearer than Sydney, a distance of 12 miles, the shipments of coal without the aid of a railway are necessarily limited. In 1869, 21,000 tons were shipped direct from the mines of the company, and a railway to the coast is expected to be completed in August or September. The contractor is Mr. Duncan Macdonald. A great deal of the coal produced by the company is forwarded to New York.

AUSTRALASIAN COAL.—The production of coal continues to increase satisfactorily in New South Wales, and some additional miners have been put on at some of the mines in the Hunter district, particularly by the Australian Agricultural Company. The report of the directors presented at the half-yearly meeting of the Waratah Coal Company, in October, showed a balance of profits amounting to about 10,000*l.*, and a balance of about 2500*l.* was carried forward to the credit of 1869-70. The railway authorities of Queensland are making a trial of coal from a recently-discovered seam near Ellora; no decision appears to have been yet arrived at by some as to the use of the new coal, which is affirmed by some persons to be of good quality.

GOLD DIGGERS OF THIBET.—The Thibetan gold field of Thok-Jalung, in latitude 32° 24′ 26″ and longitude 81° 37′ 38″, has been visited by a corps of scientific English explorers, who have just published an account of their observations. The diggers prefer to work in the winter, when nearly 600 tents are to be found there; the soil when frozen does not "cave in." They have no wood, but use dried dung for fuel, and the water is so brackish as to be undrinkable until frozen and re-melted. The gold is obtained from an excavation a mile long, 25 feet deep, and 10 to 200 paces wide, through which a small stream runs; the implements used are a long-handled kind of spade and an iron hoe. The water is dammed up, and a sloping channel left; at the bottom a cloth is spread, kept down by stones so as to make the bottom uneven; one man sprinkles the auriferous earth over the channel, and another flushes the channel by means of a leather bag, the pieces of gold fall into the inequalities, and are easily collected in the cloth by lifting up the stones. The yield is large, nuggets of 2 lbs. weight are found; the gold sells on the spot at rather less the 30 rupees per ounce. A gold commissioner, or "sarpon," superintends all the gold fields, a string of which extends along the northern watershed of the Brahmaputra, from Lhasa to Rudok. Each field has a chief, but anyone may dig who pays the annual license fee of one sarapoo or two-fifths of an ounce.

UTILISING SOLAR HEAT—NEW SAFETY APPARATUS FOR MINES.—This method is due to Mr. Delaurier, of Paris. A truncated cone, open at both ends, is silver-plated on the inner surface, and highly polished. The solar rays enter the large end, and, because of the equality of the angles of incidence and reflection, converge at the small end. As the length of the cone is increased the area of the smaller opening may be diminished, and the concentration of heat becomes greater. This simple contrivance, in the opinion of the inventor, may work out an industrial revolution, especially in Africa. We quote from the inventor's description. Heretofore we have made use of concave mirrors and lenses to concentrate solar rays. Everybody knows the difficulties attendant upon the use of large metallic mirrors having but one focus, and the great loss of heat caused by reflection. Lenses are not only a very bad means for concentrating radiant heat, being but little diathermic when thick, and, moreover, impossible of construction when one attempts to make them in sections. The process described has a further advantage in the fact that rays incident upon the surface at a small angle lose little by reflection, so that in this case almost all substances can be made good reflectors. But the chief advantage is cheapness and facility of construction. A common wooden box of the right shape, lined with tin, will be sufficient. If it is wished to get a greater concentration of rays let this pyramid be made long. Is it not possible, by this means, to obtain heat enough for ordinary purposes, especially for irrigation, by furnishing steam to engines suitably modified? M. Delaurier has also devised a means to prevent explosion of fire-damp, by a continual firing of the gas as soon as it is generated in small quantities in different parts of the mine. A wire runs through the mine from a Ruhmkorff coil which is kept constantly charged. This wire is cut at intervals deemed sufficient, and the ends are separated about four-tenths of an inch. With a coil giving a spark of two and four-tenths inches in length, he cuts the wire to (say) 10 places in the highest parts of the mine, where the gas first collects. There is no need of a return-wire, the earth serving as well. By this means the explosive compound of air and gas is set on fire as fast as the gas is generated, and the consequence is nothing more dangerous than a series of slight explosions. This is not very expensive, and the expense can be reduced by applying the process for a few minutes each day before the miners begin their work.—*Van Nostrand's Magazine.*

## MINING, METALS, AND MINERALS—PATENT MATTERS.

BY MICHAEL HENRY,
Patent Agent and Adviser, Memb. Soc. Arts, Assoc. Soc. Eng.

Mr. ISAAC JAMES, of Cheltenham, has obtained a patent for an invention for machinery or apparatus for crushing or breaking stones, bones, and other hard substances. In carrying out this invention machinery is used, the motion of which is rotary and continuous. In a frame are mounted and geared two or more hard metal rollers, having straight or helical fluted surfaces. These rollers are placed opposite to each other, so that the edges of the flutes (teeth, notches, or grooves) in one roller cross or intersect those on the opposite roller, and cut, break, or crush the bones or other substances passing through the space between the said rollers. A shaft is passed through each roller, and turned by separate driving gear and fly-wheel, worked either by hand or other power. The bearings or brasses of the roller-shafts are made reversible, for adjusting the distance or space between the cutting or crushing surfaces of the said rollers. In some cases the grooves or flutes on one roller may be straight, and inclined on the other (or both may be straight, and one or two pairs of such rollers may be used in one machine, one pair being mounted above the other pair; in this case the teeth or grooves in the upper pair are made coarser than those in the lower pair. A suitable hopper is provided over the rollers for containing the substances to be crushed or broken.

Mr. W. R. LAKE, of Southampton-buildings, Chancery-lane has specified an invention for a method of, and apparatus for, removing artificial coatings from metallic surfaces. Communicated to him from abroard by Byron Horatio Harmon, of Clifton Springs, and Philip Henry Rose, of Canadaigua, both in the State of New York. This invention consists in a method of removing artificial coatings from metallic surfaces by subjecting the same to a current of hot air, steam, or gases, or any of them combined, in a retort provided with a receptacle for holding the material, which receptacle receives mechanical agitation to detach the coatings as they become melted. It further consists in the construction and arrangement of the apparatus by which the result is secured. The process may be applied to the removing of coatings either of sheet or solid metal, such as bars or pieces. It is especially effective, however, in removing the coatings of tin from scraps or chips of what is called in the market "tin plate," old ware, &c. The coatings thus removed are re-melted in mass, and serve for subsequent use as well as at first.

IMPROVEMENT IN TREATING LEAD ORES.—In treating ores of lead Mr. CHARLES CROCKFORD, of Holywell, Flint, purposes to convert the galena into sulphate by calcination; then treat it with common salt to form sulphate of soda and chloride of lead, and after washing out the sulphate he dissolves out the chloride with chloride of calcium, and then precipitates the lead with a re-agent, according to the product required. Chloride of magnesium, barium, &c., may be substituted for that of calcium. He also proposes to treat bluestone by grinding and desulphurising the ore, collecting the sulphurous acid gas to make sulphuric acid, and chloridising the desulphurised ores. This done, he washes out the chloride of copper with water; dissolves out the chloride of silver and lead with chloride of calcium, &c.; next precipitates the silver with copper, and afterwards throws down the lead. The residre, which consists of silver, with oxides of zinc and iron, is treated with weak sulphuric acid to dissolve out the zinc, which is precipitated with sulphate of sodium. The process is capable of some modification.

TRIAL OF NEW ROTARY ENGINE AND PUMP.—On Tuesday last we were invited to witness some interesting experiments on a new rotary engine and pump (Bennison's patent), which is being manufactured by the Rotary Engine and Pump Company, of 8, Old Jewry. The trials were made at Phœnix Wharf, Greenwich, where many of the engines have been manufactured, and where one has been at work for some nine months, showing no signs of wear, and having required nothing in the shape of repairs. Many attempts have been made from the time steam was first used as a motive power to construct engines which should communicate a direct rotating motion to a shaft, without the intervention of connecting-rods, guides, cranks, &c., which are necessary in ordinary engines to convert a reciprocating motion into one of continuous rotation, it being supposed by many that a considerable loss arises from this change of direction or character of the motion communicated. This, however, is well known to mechanics not to be the case, no loss arising by the intervention of a crank, which gives out the whole of the power communicated to it in a very convenient and simple way. Nevertheless, there can be no doubt that a certain charm, to say the least of it, exists in the idea of getting a revolving motion direct from an engine, and in dispensing with the parts referred to, both on account of the simplicity of appearance, and, it may be said, the saving of space involved, and also the saving of expense which there would be if rotary engines are to take the place of reciprocating ones. Perhaps one of the chief reasons which may be assigned for rotary engines not finding favour is that, as a rule, they admit of no arrangement for working the steam expansively, swallowing up, so to speak, as much steam as their capacity allows, and discharging it at the same pressure as it enters, or nearly so. Now, this is not the case in an ordinary engine, however carelessly made, the steam being expanded to some extent, the passage being closed before the stroke is completed, or the cylinder quite filled. Another defect inherent in almost all rotary engines is that the moving parts constituting it travel at different speeds, as do also the different portions or sides of the same pieces; this is calculated to induce unequal wear, which there are no easy means of making up or preventing. The invention before us does, however, in some essential points differ from most of the plans we have hitherto seen, and fulfils, we believe, as far as possible, all those conditions of fair and even wear of which rotary engines are capable; and this is saying a great deal, for it is not regular wear that is objectionable, if the parts wearing are "followed up" by other portions of the structure, or are capable of easy and ready removal. One point it is most essential to bear in mind in judging of the amount of durability in the working parts of engines or machines of any kind, and that is that no injurious wear arises where surfaces are merely in contact, but not pressed together by weight, springs, or otherwise. Thus, it has been found that a rectangular block, well finished, working between two properly prepared and rigid surfaces, will work for years, and keep steam-tight; whereas it is well known the face of an ordinary slide valve rapidly wears, being subject to the pressure of steam on the back, forcibly holding to the cylinder facing. In the engines now under view several surfaces which are required to be steam-tight are of the character first referred to, being merely surfaces of contact, and not under pressure, so that if once made right they will wear for a very long time, and remain in perfectly good order. As a proof of this, in the engine working for some time at the Phœnix Wharf the file or tool marks left on such surfaces are not obliterated after continual working of many months. Without drawings it is difficult to describe a piece of mechanism so as to render it intelligent to non-professional readers. Taking a 6 or 8-horse engine, it is in shape and size not unlike a bat-box turned on its side. Within this shut cylinder another cylinder, somewhat less in diameter, is placed, this being fixed to a straight shaft, and which revolves with it, and communicates motion to any machinery to be driven. A piece of metal, in the form of a crescent, is placed between the inside of the outer and the outside of the inner cylinder, and is so made as entirely to fill up the space between them, just in the centre or upper portion. There are also two slide plates or "pallets," about ¼ in. wide, which freely slide in grooves cut in the inner cylinder, and which are actuated by a cam fixed on the shaft, before alluded to. The edges of these "pallets" are always kept in contact with the inner surface of the outer cylinder, except when in their rotation they pass off the surface of the crescent-shaped piece, or "H cam," before spoken of. The effect of these arrangements, which are really very simple, is to alternately enclose spaces between the two cylinders, in which the steam acts with a force proportionate to the area of the "pallets"—that is, such portions of them as project beyond the smaller cylinder. The power of these engines may almost be said to depend upon the boilers from which they are supplied with steam, as their speed may be from 100 to even 600 revolutions a minute, the power varying with the speed, full steam being supplied to them. From what has been said it will thus be fair to assume that these engines are almost all that can be desired as regards durability. They are also very cheap, and occupy very little space, while for moderate powers, and where economy of fuel is not very important, they will not be objected to on the ground of expense for fuel. For larger powers we think it will be absolutely necessary to provide expansion valves, or some contrivance for shutting off the steam before filling the spaces designed for it to work in, so that at least half the space only may be occupied by steam from the boiler, the remaining half being filled by the steam in its expanded state. If this were done, and for small powers without such arrangement, we may confidently state that these engines may be relied upon, and are, so far as our experience or information goes, the best rotary engines yet devised. As rotary pumps, of course they are quite as efficient as for engines, inasmuch as the pressures usually are not so great under which they work, and every loss from leakage is less consequence than when steam is employed. There can be no doubt that at all moderate speeds, even up to 400 or 500 revolutions a minute, the quantity of water delivered would be equal to the capacity of the spaces filled. This being so, all experiments in pumping, as to quantity, &c., will simply depend upon the speed given to the pumps, and the power employed in driving them. We advise all contractors, brewers, engineers employed in draining, and others requiring simple pumping machinery, to examine into this improvement, and we have no doubt they will find ample to re-

ward them for so doing. As water-power or hydraulic engines they will also be found most efficient, and we think the cheapest motor to be had.

A large number of gentlemen interested in the question assembled on the day named for the experiments, in response to an invitation issued by the company. The visitors were received by Mr. Charles B. King, C.E., the chairman of the company; Messrs. Doncaster and Bruce (directors); and Mr. B. de Michelé, C.E., secretary. Among those we noticed were Mr. John Braithwaite, C.E., Mr. Nathaniel Grew, C.E., Mr. Beattie, C.E., Mr. Alban Meredith, Mr. Stocker, Mr. Compton Merryweather, Mr. Edward E. Allen, C.E., Mr. Deacon, Mr. Mamble Sedley, and many others. The experiments were highly successful. The first consisted in working the pumps of the company by hand-power, when one of the No. 1 size, being equal to 6 inches area, pumped water from the Deptford creek through 10 ft. of section, and through 85 ft, of 3 in. delivery hose to a distance of 45 ft. in a steady jet from a branch pipe having a ⅜-in. nozzle. Another experiment was made with a similar pump worked by a 6-horse rotary engine of the same patent. This showed some wonderful results, for it pumped water from a tank with about 3 ft. of section to a vertical height of 30 ft., and discharged the same through a ¾-in. nozzle to a distance of 45 ft. The whole of the experiments were of a most satisfactory character, and the spectators expressed themselves much gratified with the results.

# The Royal School of Mines, Jermyn Street.

## Mr. WARINGTON SMYTH'S LECTURES.

[FROM NOTES BY OUR OWN REPORTER.]

Lecture XXV.—If a lode were of small size (said Mr. Smyth) a question would arise as to whether it would be better to drive on the hanging wall side or the reverse, and it would have to be decided according to the convenience of the working, or the greater or less safety on the one side or the other. Or it might be that on one side there would be droppers, or small strings, falling in on the lode, which might make it desirable to keep to that side rather than the other. If the lode had an average width of 3, 4, or even 5 feet in width, it most likely would prove best to carry the level at the same width as the lode, and then they would have the advantage of the wall; while at other times it would be best to leave the lode, and drive in the country entirely. Supposing the lode and the ground over it to be very hard, then it will be desirable to drive on the softer side for some distance, and then attack the lode. In cases where the ore is unusually rich, and the intrinsic value, as of gold or silver, is great, it may be taken down only in the presence of the officers of the mine, to preclude the possibility of portions being surrepticiously taken away. When the lodes do not maintain their width, and they often vary as much as from 6 feet to 6 inches, the level must be carried at the full size. Supposing you have to deal with a tin capel, or a dense quartzose material, you will find in many cases that it is better to carry the exploratory level at the side of the lode, on account of the smaller expense of labour, which may amount to 10*l*., 15*l*., or 20*l*. per fathom on the lode, and probably to not more than 3*l*. or 4*l*. if the side rock is softer. You have also an advantage in the greater rapidity with which the work will proceed, probably three fathoms to one on the lode, and then an occasional cross-cut, by way of exploration. This is frequently the case in Cornwall, where it is found preferable to drive in the granite, and to cut into the lode occasionally to see what it is like. The intervals at which these cross-cuts should be put in must depend on the nature of the material to be dealt with. At the Sharp Tor Mine it took periods of six months, and sometimes nine or ten months, to cut across the vein being of great size and tremendously hard. In a general way, however, a level driven in this manner by the side of a lode ought not to go more than 15 or 20 fathoms without a cross-cut.

The next point for consideration is the support to be given to the walls of levels, and this will also affect their position. It might happen that with a lode of loose material, 6 feet in width, the cost of timbering and propping would be great, while the firmer ground at the side might not require a quarter so much support. In other cases it may be well to have the level partly in the lode and partly out of it, a plan which has the advantage of revealing the nature of the lode without cross-cuts. In all cases care must be taken to secure the main thoroughfares. If the level be carried along the foot-wall of a lode it will generally be necessary to protect only the roof and one side by means of timber, or by dry walling. Under such circumstances the drift is carried parallel to but at some distance from the lode, which is worked by means of cross-cuts, and then, whatever may happen in the way of collapse, there the communication remains unbroken. All these details will vary very much, according to the class of mine in which they are carried out, and the most economical modes of supporting the roof and guarding against collapse. There is no question more frequently raised than that of whether the men are in the lode or not. Thus, the manager will go down and find the men all aghast because they have, as they term it, lost the lode. That is to say, it has gradually died away, until no trace of it is visible; or, at least, nothing that they acknowledge to be a lode. Thus, at the Great Laxey Mines, in the Isle of Man, they had a magnificent lode of rich lead ore, from 12 to 14 feet in width, between walls of quartz and dolomitic spars, when suddenly it died away, and was completely lost. What was to be done? It was at length determined to continue the drift in the same direction, and after a while the lode resumed its former dimensions and richness. Losing the lode may, indeed, occur in several ways, and these things show how constantly the mine manager is required to be on the alert, that he may neglect no chance to advance the prosperity and success of the property entrusted to him. The matter is much the same within the walls of the lode itself, and it may be necessary, if the lode be a large one, to search within it for the ore-bearing portion, just as the search may be conducted for a small lode in the country. If a lode be 40 or 50 feet in width it will seldom be necessary to take out the whole, and the level may be driven on either side of it, or in the middle. The first thing, therefore, in such a case is to cross-cut from side to side, in order to discover the portion which presents the best probability of profit and success. If a continuous rib of ore run near the north or south wall the level will, of course, follow that rib; but frequent cross-cuts should be made, to see what takes place in the mass of the lode. Supposing, then, that the ore-bearing portion of the lode which we are following is lost, what are we to do to regain it? The men will have a natural tendency to go on in the same line, and thus if the ore has changed its direction they would never see it again. The first thing would be to cross-cut, but if that were not successful they must come back along the level to where the ore was parted with, and then by careful examination indications will probably be found which will show which way the men ought to have followed. As a general rule, it is well to be guided by the general average bearing of the lode, and keep the level in that line, and cross-cut. In the case of large veins orey portions will often be found running side by side, and a judicious cross-cut will often open out new riches. There is a case on record in which this was neglected to be done, and it was afterwards found that a rich course of ore ran at a small distance for some fathoms alongside the level.

We will now look at the means by which when the ground is not sufficiently strong for the level to maintain itself it will have to be supported. Here we come to a marked difference between the circumstances of metalliferous mining and the working of stratified deposits, the latter being generally more or less horizontal, while the metallic minerals have to be sought from below. The chief methods in use for supporting the roofs or sides of galleries or levels are by timbering or arching with brick or masonry, but the expense of establishing and maintaining timber for the working of a mine is so considerable that too much attention cannot be given to the discovery of the most economical plans. It is, therefore, for the mining agent to make himself acquainted with all the best systems, and he will then be able to select that which will suit the particular circumstances he has to deal with. Timber may have to stand a sudden application of force, but as a rule it is used to counteract a continuous pressure. In many countries the tops of levels have a tendency to come down, the sides to bulge in, and the floor to rise. Occasionally, in hard rocks, many years will elapse before the slightest effect is produced, but, practically speaking, there will always be portions likely to break in, and, therefore, requiring artificial protection, the application of which will be guided by the strength of the floor and the direction of the thrust.

The timber used in mines should possess certain qualities, which should be taken into account in choosing the kinds to be used. Resistance to decay is an important quality, and price, too, is a matter for consideration. When estimating the strength of timber the various ways in which it is used must be remembered. In the long wall system single props are much required, and at other times it is used, to resist pressure, transversely to the fibre, or to bear a strain both ways, having a tendency to pull the fibre asunder, as in the case of pump-rods. It is plain, then, that one kind of timber is best suited to a particular sort of work, and another to another. With regard to cost, it is obviously impossible to lay down any rule. In the Hartz, where the mines are in the midst of pine forests, timber is obtained at an easy rate, and suitable for the purpose. In Cornwall, where there is but little timber, that defect is supplied by a good seaboard, but in other countries, as in Spain for instance, it has to be conveyed considerable distances, at much expense. Generally those districts which have a seaboard enjoy great advantages. Thus, in Cornwall we see magnificent Norwegian and other timber, some of it brought, indeed, from the ends of the world, as a great deal of first-rate quality is brought from Vancouver's Island. The different kinds of firs and pines produce straight, light, and cheap timber, many sorts having great durability besides. The larch (*pinus larix*) has the advantage of resisting alternations of damp and dryness, and is less liable to rot than most other woods of the pine genus. It also resists very well the heavy weights which have to be supported in timbering levels. Another excellent wood is that of the spruce, or Norwegian fir (*abies excelsa*). Timber which is known as Scotch fir (*pinus silvestris*), but which comes from Memel and Riga, and ought really to be called Baltic timber, is a good kind, while that which is grown in Scotland is very inferior, and of quite a brittle character, compared with the other. The silver fir (*pinus abies*) is a beautiful tree, but does not furnish so good a wood as others of the same species, but is frequently used in the Hartz, where it is readibly obtainable. Oak is largely employed, and possesses in an eminent degree the qualities of strength and durability, but it is very expensive, and especially so if the levels are large. In thin seams, where it can be employed as props, in short pieces, without much cutting and shaping, it is very useful, and lasts ten times as long as the *coniferæ*. Larch is not very inferior to the oak, but the others are not to be compared in durability. In some countries beach and birch are much used, but they are brittle. The Spanish chesnut is largely employed in the South of Europe, and lasts remarkably well; it is also used in America a good deal. The acacia is used in many districts of Italy, in the South of Europe, and in Brazil, and is well spoken of as resisting the alternations of wetness and dryness.

When single props are put in to support the roof of levels, it is generally necessary to place a piece of timber, called a head-board, at the top to equalise the pressure, and to bring the support to bear upon a larger area. When the floor is soft a foot-piece, on the same principle, is used. Props are largely used in some collieries, sometimes up to the face of the workings, and then as the coal is got the props are removed, and the roof is allowed to fall in. The removal of the props is a work requiring great judgment, as if sufficient care be not taken a fall will take place before the men are ready for it, and their lives are jeopardised. In some places the work is simple, a few blows struck at the bottom of the post with a heavy hammer being enough. Sometimes they are dragged out with a hook and chain; occasionally a small crab or winch is introduced. As a rule the props ought to be got out, from motives of economy, but sometimes by the practice of a small gratuity being paid for every one brought out the men are induced to run risks which they ought not to encounter. Iron props have been tried in some collieries, cast in sections, so that by knocking out a key-piece they can be removed without difficulty, from the back to the front. Iron props, however, do not appear likely to meet with a general adoption. In metalliferous mines a few props from side to side, called stull-pieces, or stemples, will often suffice to keep the opening safe for some distance.

The lecturer concluded by exhibiting a number of models, which illustrated different modes of single propping, and various kinds of props.

## THE IRON AND COAL WORKS OF SOUTH STAFFORDSHIRE.

Many of the blast-furnaces in this district have now the latest improvements applied to them, with the exception of increasing their height. An increase of 20 ft. or more in the height is generally regarded as desirable, but little has been done in this direction. The blast-furnaces at Parkfield, Willenhall, Pelsall, and Rough Hay may be instanced as works where improvements are in successful practice. The boilers and stoves being heated by the waste gas, the smoke produced by coal firing is avoided, an important consideration for South Staffordshire, as it involves the questions of economy of fuel and smoke prevention. The outlay required for this alteration has been in many cases repaid within two years, from the value of the fuel which is dispensed with. Many of the furnaces are held under lease, which, no doubt, prevents the development of improvements in those cases. It has been calculated that the waste heat from puddling and balling furnaces is generally sufficient to generate steam to drive the machinery of the forges and rolling-mills—this is another important consideration. If the waste heat can be utilised, on the culvert principle, for heating boilers set in the ordinary way, as is done at some iron works in other districts, fuel would be economised, and an immense benefit result to the neighbourhood, in the absence of a dense smoky atmosphere, for which it is proverbial. Progress in the mode of working coal in South Staffordshire has been too long delayed, until there is little left to operate upon in the old district. An instance of improved methods of working and raising coal is given at Pelsall Colliery, where the roads are driven out considerable distances underground, and artificial ventilation is adopted. As the circumstances in the old mines are the same as at Pelsall, there is no reason why 400 tons per day should not be raised by one engine, from one or a pair of pits close together, in one district as in the other. It is important to have at command a regular current of air through mines. In trusting to variable natural ventilation, so common in the old pits of this district, a healthy supply of air cannot be relied upon; public opinion is moving for the adoption of better measures in this direction. A ventilating fan—Guibal's—is in operation at Cradley-heath Colliery. Screening coal is practised on an improved principle at the new Hawne pits, belonging to the New British Iron Company. These are exceptions to the rule: the owners of works do not give that attention to the ventilation of mines and to screening coal which the importance of these subjects requires, and screening would, moreover, be of considerable economical advantage in the separation and cleaning of coal.

Pelsall Iron Works.—These extensive works, situated about two miles north from Walsall, are the northernmost iron works in the South Staffordshire district; they are under the proprietorship of Messrs. B. Bloomer and Son, and consist of blast-furnaces, puddling-forges, and rolling-mills, collieries, and mines under an area of about 500 acres. The mines are adjacent to and work the same seams as those established on Cannock Chase. There are two blast-furnaces at Pelsall, erected in the year 1840; both are in blast. They are 47 ft. high, 12 ft. wide at the bosh, 5½ ft. in the hearth. They are round, built on brick pillars; one is cased with iron, the other is hooped with iron. The waste gas is taken from the top of each of them by means of chimney draught. The system of withdrawing the gas is the same in each, the furnaces being quite open at the top. There are 13 openings, 2 ft. high, 1 ft. in width, from the interior of each furnace into the gas-chamber; the chamber is 3½ ft. wide, and 4½ ft. high at the middle, sloping in the bottom towards the furnace, so as to prevent any deposit of soot in it. The gas is conveyed away from the chamber in pipes lined with fire-brick. No. 1 furnace heats five boilers, and the stack in connection with it is 145 ft. high, 11½ ft. square at the base, and 12½ ft. at the top inside. The gas from No. 2 furnace heats two stoves, and the stack connected with it is 120 feet high, 7 ft. in diameter at the base, and 8 ft. at the top inside. One stove is appropriated to each furnace. No. 2 stove contains three rows of 12-in. metal pipes, 12 ft. long; each row consists of nine double pipes, or 27 in the stove; the blast passes through the whole series in each row. No. 1 stove contains pipes of the same size, but there are only 22 double pipes in it. The temperature of the blast is maintained at about 1200° at the tuyeres; there are five tuyeres to each furnace. No. 1 furnace produces about 140 tons of iron per week, and No. 2 about 160 tons per week of grey forge iron. The materials are raised by an incline at the top of the furnaces; one carriage, three-linked chain, and a 14-in. cylinder beam-engine being used for this purpose. The blue flats and brown mines, got from their own pits at Bloxwich, and hematite ore from Cumberland, are mixed with raw coal, and coke imported from South Wales and other parts, in one furnace. In the other the native mine and Northampton ore are used, producing pig-iron of a lower quality. The mountain limestone from North Wales is used as a flux, or Froghall limestone. There are two blowing-engines placed in separate houses, both going at the rate of about 13 strokes per minute. No. 1 is a beam condensing-engine, without fly-wheel; steam-cylinder, 42 in.; blowing cylinder, 84 in., at opposite ends of the beam; 7-ft. stroke. No. 2 is also a beam condensing-engine; steam-cylinder, 42 in.; blowing-cylinder underneath, 84 in.; 7 ft.-stroke. A connecting-rod from the opposite end of the beam actuates the fly-wheel. When one engine is stopped for repairs the other can be driven at the rate of 24 strokes per minute. There are seven boilers in connection with both engines; five of these are heated with gas, and two fired with slack. Pressure of steam, 22 lbs.

Puddling-Forges and Rolling-Mills.—There are three forges, 32 puddling-furnaces, and 12 mill-furnaces. To each forge an engine is attached, having one or more mills on the opposite side at each. Two of the engines are condensing beam-engines, cylinders 42 in. diameter, and 7-ft. stroke in one case, 8-ft. in the other. The new forge and mill are driven by a pair of horizontal engines, to which condensing apparatus is being added. The steam for these engines is nearly altogether generated with waste heat from the puddling and mill furnaces. The mills comprise one sheet-mill, one 15-in. train for rolling bars, and occasionally used as a slitting-mill; one 10-in. hoop-mill, one 6-in. hoop-mill; a 20-in. train for rolling strip-iron, from 10 in. to 24 in. wide, working alternately with an 18-in. bar-mill on the opposite side of the engines. There are two circular saws, driven with frictional gearing, and shears to each mill.

Adjoining the blast-furnace cast-house there is a large foundry, at which all the castings used for the works and collieries are made, as well as a considerable quantity for sale.

The iron works and collieries are connected with the South Staffordshire Railway by a branch of about one mile, on which two locomotives are constantly used for the conveyance of materials.

Pelsall Collieries.—The whole output of coal is raised at Nos. 8 and 9 pits. These pits are about 50 yards apart, the winding-engine is placed between, with a rope to each pit. Both pits are sunk through the Deep coal seam. No. 8 is the upcast, and from it the Shallow coal is raised; depth, 60 yards. No. 9 is the downcast, and from it the Deep coal is raised; depth, 75 yards to the seam. About 400 tons per day is the maximum output from both these seams (which will shortly be nearly doubled), two-thirds of this is obtained from the Shallow coal. This is an important improvement on the mode of getting coal which is still practised in the old mines of the South Staffordshire district, where the rule has been, and is, to draw from four pits with one engine from 25 to 30 tons per day from each, which necessitates increased capital for chains and tackle, and a greater amount of labour. The Nos. 8 and 9 winding-engine is of the beam construction, 42-in. cylinder, 6-ft. stroke, condensing, two plain drums for round wire-ropes. The engine works to the drum with cog-wheels of equal size. It has been used for winding and pumping at the same time, the pumping-pinion and spur-wheels are in the ratio of 1 to 2: it can still be applied to pumping if required, but that is now done by a separate pumping-engine placed near the former. Pumping beam-engine, 20-in. cylinder, 4-ft. stroke, pinion and spur-wheels, proportioned as 1 to 6. By means of a face-plate, horizontal rods, and two T-bobs placed over the upcast, this engine works two 12½-in. bucket-lifts, 80 yards in depth, both delivering to the surface. The stroke is 6 ft. in the pumps, and seven strokes are made per minute in the pump. A part of the pit is partitioned off for the pumps. Section of the Shallow coal seam:—

| | | |
|---|---|---|
| Cliff roof. | | |
| Shallow coal | 5 ft. | 0 in. |
| Fire-clay, holing | 0 | 6 |
| Strong clunch. | | |

This coal is being worked to the rise of the pits, on the long wall system. The rise averages 2½ inches per yard eastward. The gate-roads are from 30 to 50 yards apart; a pillar of four yards is made on each side of the gate-roads, and between the gate-roads openings four yards, and pillars four yards wide, are left alternately. The face of work is now nearly in one straight line, and about 1000 yards long. Section of the Deep coal seam:—

| | | |
|---|---|---|
| Roof coal, left for roof | 1 ft. | 0 in. |
| Clod | 0 | 6 |
| Deep coal | 5 ft. to 5 | 6 |
| Fire-clay, holing | 0 | 6 |
| Clunch. | | |

This is also being worked to the rise, on the long wall system, but not so extensively as the Shallow coal, owing to difficulties from water coming from the top, and colliers refusing the work. The ventilation for the two seams is effected by a furnace placed in the Shallow coal; about 10,000 cubic feet of air per minute is in circulation. There is no fire-damp; black-damp is the only gas produced, being given off from old workings. Wooden tubs with flanged wheels are used for the Shallow coal; each carries about 10 cwts. of coal. This coal is manipulated by hand-labour on the bank into five classes—large hand-picked (which is sold), forge coal, seconds, kibbles, and slack. Skips are used in the Deep coal, with iron rings to raise the load. This coal is separated underground into two kinds—large and small; the large is used chiefly in the blast-furnaces. There are 30 horses employed underground. No engine-power at present is used, although over 1000 yards of road in the Shallow coal is being laid out to be worked by engine-power. Each cage raises one tub or skip at once, and runs on two wooden conductors. The cages are provided with Broadbent's safety-catches; these are modified, they act by a weight instead of a spring, and thereby are found less liable to get out of order. The catches have several times acted when accidentally put to the test. It is highly desirable to have an apparatus of this kind perfected as much as possible, so as to be reliable in those cases of accident against which they are to provide.

The water engine at No. 3 pit is of the beam construction, 30-in. cylinder, 5-ft. stroke, non-condensing, pinion and spur wheels proportioned as 1 to 2. Motion is given to the pump-rods by means of a face-plate, horizontal rod 60 yards long, and two T-bobs over the pit. There are two 12½-in. bucket lifts, 80 yards in depth, both of which deliver to the surface; 18 strokes per minute are made in the pumps. A small horizontal engine, placed alongside the water-engine, is used for lowering and raising men in the pit.

The Newlands water-engine is a 20-in. cylinder beam engine, 4½-ft. stroke, condensing, pinion and spur wheels proportioned as 1 to 3½. Motion is given to the pump-rod by means of a crank, a short horizontal rod, and one T-bob. There is one bucket lift, 12½ in., 60 yards in depth, 5½-ft. stroke. One 8-in. forcing pump has lately been added to the same end of the T-bob, this is 45 yards in depth, and delivers to the surface; the main pipes for the latter are 6 in. diameter. The pumping at this pit was for some time effected by a chain pump (Bastier's patent), the pipes were wrought-iron, 6 in. diameter, and enamelled. The liability to breakage of the chain was the cause of its being abandoned.

It is calculated that 5000 tons of water is raised per 24 hours, by the three water-engines at Pelsall, which are in action day and night. This large influx of water is accounted for from the sandy and pervious nature of the upper deposits. It is pounded in the old workings to the rise, from whence it finds outlets to the present collieries, and as these are drained the working of the Deep coal can be more advantageously carried on.

Mining in Colorado.—We have received from Central City, Colorado, a box of ores from a mine which it is intended shortly to introduce on the British market. The ores are worth $31 for gold and $192·66 for silver. The sample forwarded represents the bulk of ores now at surface. The lode at 110 ft. deep is 3 ft. wide, with a leader of such ore as the box contains 1 ft. 6 in. wide, making larger and richer in going down. An unlimited quantity of the same kind of ore can be raised. The ore is well worthy of inspection.

The Mineral Wealth of Victoria, Australia.—We have been favoured by the Secretary for Mines, Mr. R. Brough Smyth, with the official reports of the mining surveyors and registrars for the quarter ending Sept. 30. During that period 235,874¾ tons of quartz were crushed, yielding on an average 10 dwts. 2·4 grs. of gold per ton, or 119,118 ozs. 13 dwts. 20 grs. in all. In the same time 52,854 tons of quartz tailings, cement, and mullock, gave at the rate of 3 dwts. 14·61 grs. per ton, or 9537 ozs. 8 dwts. 12 grs. in all; and 412 tons of pyrites and blanketings, gave 3 ozs. 3 dwts. 12·27 grs. per ton, or 1308 ozs. 6 dwts. 17 grs. in all. In the Ballarat district there has been a reduction in the yield of gold in the central division, owing to some of the principal companies having been flooded out with water. The tone of the southern division generally is progressive. In the Buninyong division there is a large amount of prospecting for quartz being done. The mining prospects of the Creswick division continue good. In the Sandhurst division of the Sandhurst district skilled miners have been, and are, in demand, as many have left the companies they were working for to take up ground on their own account. In the Gippsland district, the miners of the Upper Yarra are nearly all making fair wages, and during the ensuing summer months expect improved results. The reports from most districts are very encouraging.

Skilful Engineering.—The grandest underground work in the world is, perhaps, the Ernst August Gallery—one of five belonging to a metal mine in the Hartz. "The mouth of it is at Gittelda, in Brunswick. It is 10 feet high, 6½ feet wide, and has a fall three-fifths of an inch in a yard. Like a railway tunnel (but it is twice the length of the longest), it was begun simultaneously at various different points, and finished in 13 years. The gallery is 6¾ miles in direct length; but if its lateral branches are taken into account, and a subterranean gallery navigable for boats, which opens into it, the Ernst August Gallery is not less than 15 miles long. The survey was so skilfully made, and the plans so accurately drawn, that all the junctions of the different sections fitted accurately into each other; the admirable precision of the results having been partly insured by the aid of a magnet, weighing 200 lbs., which influenced the compass through the solid rock 65 ft. deep, and which was kept in one of the working places, while the compass was held in the other."

Year Book of Facts.—The annuals from time to time prepared by Mr. Timbs are now looked for almost as anxiously as the almanacs, and are in themselves, as interesting as the almanacs are unattractive. The Year Book of Facts for 1870, just issued by Messrs. Lockwood and Co., of Stationers' Hall court, contains even more abundance of interesting matter than usual, and whether the portions devoted to the mechanical or useful arts, natural philosophy, electrical science, chemical science, zoology, botany, geology and mineralogy, or astronomy and meteorology, be turned to, there will certainly be found plenty to occupy a leisure hour.

A valuable salt mine has just been discovered at Segeberg, in Holstein. The deposit is proved by various borings to embrace an extensive territory; and the Prussian Government has made a grant of 300,000 thalers for the purpose of working the mine.

The New Vade Mecum (invented and manufactured by Charles H. Vincent, optician, of 23, Windsor-street, Liverpool) consists of a telescope well adapted for tourists, &c., to which is added an excellent microscope of great power and first-class definition, quite equal to others sold at ten times the price. Wonderful as it may seem, the price of this ingenious combination is only 3s. 6d., and Mr. Vincent sends it (carriage free) anywhere, with printed directions, upon receipt of Post Office order, or stamps, to the amount of 3s. 10d.

London: Printed by Richard Middleton, and published by Henry English (the proprietors), at their offices, 26, Fleet Street, E.C., where all communications are requested to be addressed.—*Feb.* 19, 1870.